KONECRANES

Ways to help improve the safety of ports equipment

Whitepaper

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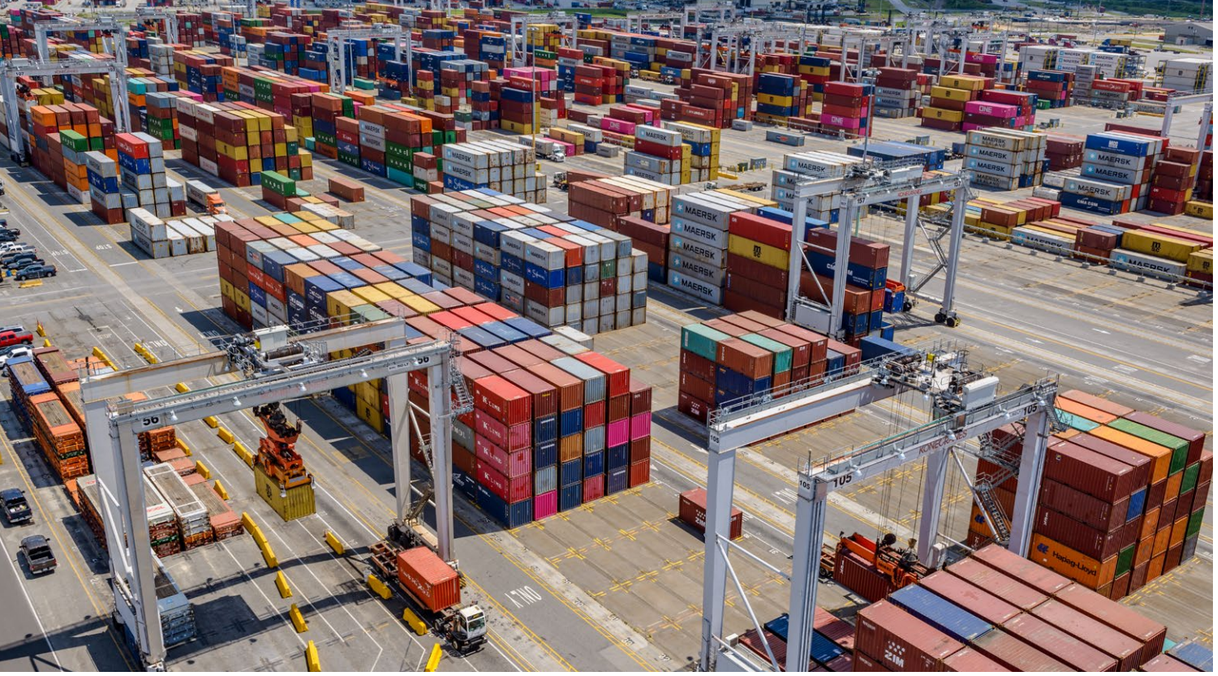
1 Executive summary

Main points

Good safety in your port ensures that your personnel can go home to their families and come back to work tomorrow. Safely functioning equipment maintains your productivity and the trust of your customers to do the job. A lack of safety can result in serious injury, significant damage, and high costs. So the safe operation of ports equipment should be the highest priority of every port business.

At Konecranes, safety is embedded in our values and built into every piece of ports equipment we manufacture. This paper presents our best recommendations about safety when using that equipment. Find out how predictive maintenance, quality parts, good training, the latest on-board technology and a selection of digital services will help you to maximize safety in your operation.



2 Introduction

Why safety matters

Heavy machinery, moving vehicles and deep water make ports a dangerous place to be. So safety must always be the first priority. Everyone should be able to return home safely after work.

A lack of safety can result in terrible injuries or fatalities. Besides the human cost, replacing equipment, lengthy downtime and legal liabilities all place a heavy burden on any business. Prevention is always better than dealing with the consequences of poor safety measures.

Safety starts with a proactive preventive maintenance program to ensure the ports equipment in your service is always in good working order. But what other options are there? Your equipment must be fitted with the right parts. Your personnel need expert training so that they always know what to do. Modern technology offers a wide range of special features to make operating cranes, lift trucks and other machinery much easier and safer. Existing equipment can be upgraded with retrofits or modernizations. Digital services can provide you with the data and insights for smarter operations and better safety decisions.

Good safety also helps to increase productivity. For example, a smart feature like Stack Collision Prevention helps Rubber-Tired Gantry (RTG) operators avoid surrounding containers and instead focus their attention on placing the container in the right location. Remote monitoring provides equipment data in real-time to reduce the risk of failure and maximize uptime.

Safety should be integral to every port. With so much to take into account to ensure the safest possible work environment, we have prepared this white paper to show you some of the most effective ways to maximize safety around your ports equipment.

You can then make a well-informed choice about the safety measures best suited to your needs.

3 Maintenance

Resolve issues before they become problems

Maintenance is the first step in maximizing safety. It is a complex technical task that should only be carried out by qualified professionals. While your drivers can check their equipment after only basic training, you need expert personnel on your team to take care of regular maintenance tasks. For more advanced tasks, you will benefit from the services of dedicated crane service companies.

Poorly maintained machinery can seriously compromise safety. If a rope snaps, brakes fail or a container drops, people can be badly hurt. Good maintenance is absolutely essential.

Preventive maintenance consists of regular scheduled maintenance and repairs to ensure your equipment is in full working order. As the name suggests, it tries to prevent problems with a predefined maintenance program and is the most common form of maintenance.

But like brushing your teeth twice a day to prevent cavities, preventive maintenance can only do so much for your equipment.

Predictive maintenance anticipates the future with condition and usage data to forecast potential maintenance issues before they affect safety. You can then take appropriate action well ahead of time. You can also use this information to optimize preventive maintenance plans.

The most effective predictive maintenance is customized to your particular machines, applications and duty cycles. In addition to the recommendations of the manufacturer, you must consider usage, port environment, and local regulations.

Predictive maintenance should also make use of inspection data and maintenance audits. A certified inspector can visit your site and make a detailed, customized report on the steel structure, the operating machinery, the electrical systems and the hydraulics. This is especially important for older equipment, in which the components have undergone more stresses over a lifetime of use.

For more timely information, you can take advantage of the latest digital solutions. Remote monitoring can collect condition and usage data in near real time. Your drivers and operators can inspect their own equipment daily through a mobile application. Special sensors can track equipment performance during use. After all this data has been sent to a central control point for digital collation and analysis, the result is a completely up-to-date view of the condition of all your ports equipment.

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4 Parts

Replace the right parts early

Ports equipment from a good manufacturer can last for decades. But nothing lasts forever, so eventually, you're going to have to replace some parts. Worn parts are dangerous because they can cause equipment failure that results in expensive downtime, serious property damage, or injury to personnel. When you replace parts before they wear out, you can avoid these problems and extend the life of your equipment.

Preventive maintenance programs usually replace parts on a predetermined schedule based on estimated useful lifetime. Predictive maintenance assesses the condition of parts to identify when they are ready to be changed. Remote monitoring can provide up-to-date usage data to ensure timely replacement.

It may be time-efficient and cost-effective to buy parts online. But you should always use Original Equipment Manufacturer (OEM) parts. Imitation parts can be just as dangerous as a worn or faulty part. OEM parts might cost more, but they've been tested on equipment just like yours, so you can be sure that they'll be available in the right size and will function correctly.

Just one crane could have 25,000 parts, so keeping track of all the parts in an entire fleet of cranes takes considerable time and effort. The OEM already knows every single part of your crane, right down to the last bolt. The latest digital services offer a direct link from your technical manuals to an online store so you don't have to search through lists of parts. AI helps you to predict and plan by analyzing usage data, identifying the parts that you will need soon and ordering them for you.

With parts available only when needed, delivery wait times are very short and downtime is minimal. If you need several spare parts at the same time, or the same part for all the cranes in a fleet, a bundled spare parts package is more cost-effective than buying one spare part at a time.

5 Operator training

Safety is based on knowledge and skills

Well-trained equipment operators are highly productive while maintaining safety at all times. Accidents can cause injury to operators or nearby personnel and badly damage equipment. Because most accidents are caused by human error, proper training minimizes the risk.

Incorrect use can lead to premature wear and tear on parts and possible malfunctions. So safety always starts with a practical, hands-on understanding of how to use equipment correctly as well as a thorough knowledge of every major component on the machine and the contents of the operating manual. A properly trained operator can maintain control of the load at all times while being able to recognize and avoid potential hazards. Training should also cover methods to minimize or eliminate load swing, communication via hand signals (for maximum visibility when radios are not practical or available) and local regulations.

All your operators need to know emergency procedures in the event of an incident, including how to cut power safely, extinguish a fire, evacuate endangered areas and administer basic first aid.

Good training is an investment in safety.

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6 Technical enhancements

Making safety easier

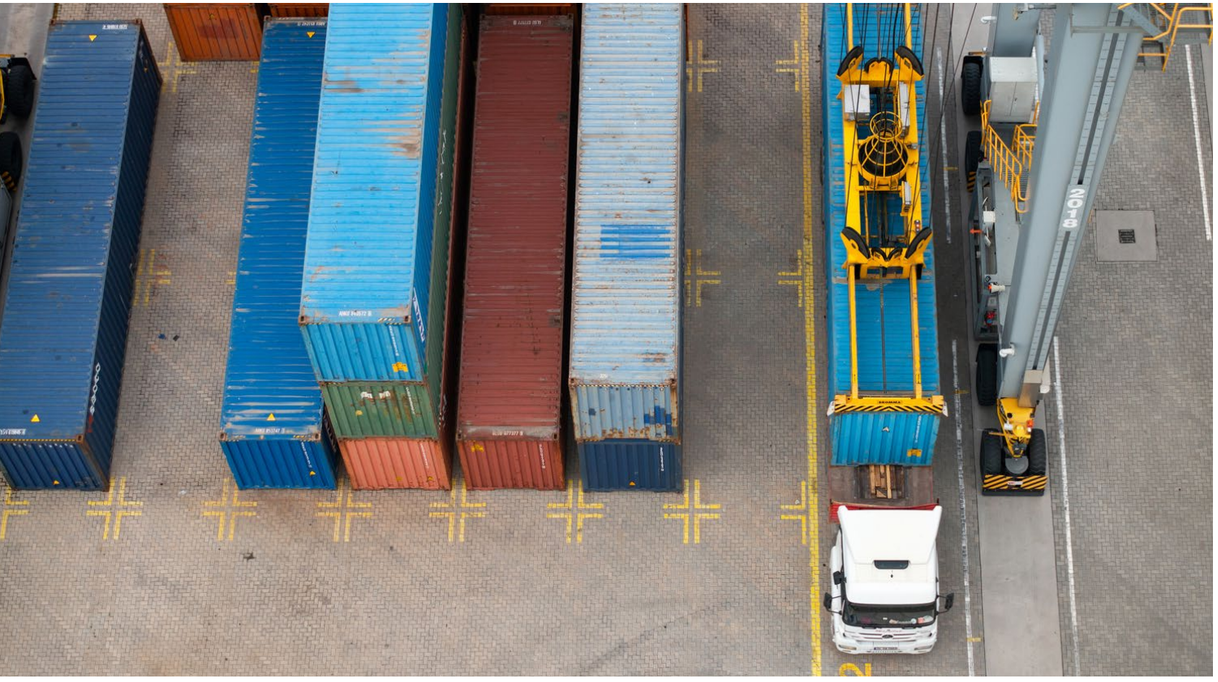
In a busy harbor terminal, the space available when handling a wide variety of cargo is often limited due to machinery, buildings and personnel nearby. Smart features are special functions designed to optimize movement and automate repetitive tasks to reduce load cycle times and the risk of human error. Some come as standard and others are optional extras to best support specific terminal requirements or local regulations. The result is improved efficiency and safety.

Some examples of smart features include antisway to keep loads steady during movement. RTGs can use auto-positioning software to ensure precision in container placement. STS cranes can have sensors built into the bogies to prevent collision with obstacles on the quayside. Mobile harbor cranes can be semi-automated for bulk handling.

Modern ports equipment is usually delivered with smart features already installed. However, because they are mostly software-based, with few additional hardware requirements, smart features are easy to retrofit on both old and new model machines as your needs change.

A remote operating station (ROS) allows the crane operator to work in a safe and ergonomic office environment with control of one or multiple cranes from the same location. Decoupling the crane and operator not only increases productivity but also eliminates the risk of being on or around the crane and the physical dangers always present a busy port. Essentially, the graphical user interface (GUI) is like a video game with intuitive and precise crane control.

Automation streamlines cargo handling with greater predictability, productivity and safety.



7 Retrofits

Upgrade to the latest technology

A retrofit adds software and/or hardware improvements that were not available when your ports equipment was originally delivered. As the name suggests, safety-assist retrofits directly address safety issues. These can be implemented on a case-by-case basis or installed as a comprehensive, standardized system upgrade on just one crane, throughout your fleet at one location or across your entire operation.

Some safety retrofits can be installed on all types of machines. For example, a fire suppression system automatically detects and extinguishes critical area fires. A simple camera installation improves driver visibility, reducing the risk of accidents. A more intuitive touch screen and a faster onboard computer offer drivers better control.

On RTGs, smart features like a gantry collision prevention retrofit helps avoid crane-to-crane and crane-to-obstacle collisions. A truck-lift prevention retrofit uses ground-level sensors to detect truck or trailer lifts and halt the hoisting action. An auto guiding retrofit ensures that trucks are located precisely for loading and unloading.

The electrification of ports equipment is a retrofit that can greatly improve safety. Less emissions means that drivers and nearby personnel work in a healthier work environment. Electric features offer more information on crane performance, providing the data needed for accurate predictive maintenance and an overall safer crane. With fewer moving parts, equipment requires less maintenance, so technicians don't move around the crane structure so much and they have a corresponding lower risk of injury.

Many safety-assist retrofits are not brand-specific and can be easily installed on and integrated into equipment that is not OEM. It's an easy and economical way to enhance the handling, function and especially safety on your existing ports equipment.

8 Modernizations

Recondition old equipment to operate like new

With a solid steel structure and regular maintenance, a crane can last for decades. But after 20 or more years, the technology onboard the crane is likely to be outdated, aging components might present a safety risk, replacing them is getting harder, and local safety regulations may have changed since your equipment was delivered.

A modernization gives new life to an old crane. As a cost-efficient alternative to new equipment, it updates technology, substitutes worn components and brings your cranes and other port equipment back to regulation standard.

There are three main ways to modernize a crane:

- First, you can change the electrical control system. These systems are developing quickly and the latest version will include all the safety upgrades added since you started using your crane.
- Second, you can replace mechanical components. The safety, lifting capacity and energy consumption of your port cranes will be restored with brand new components.
- Third, you can modify the overall structure for new applications. You may wish to raise the height, lengthen the outreach or increase the lifting capacity of your crane.

Depending on the age of your crane, modernization may be necessary before you can add technology-based services such as remote control, condition monitoring, and data support because they rely heavily on the interaction between mechanical and electrical components.

If you relocate your crane to another quay, a modernization might be required to ensure maximum safety as it serves different kinds of vessels and requires more operational flexibility. And a modernized crane ensures long-term safety because spare parts and technical support will continue be available as older systems are phased out.

9 Remote support

Minimize costs as well as downtime

Remote support is an efficient, cost-effective service that provides 24/7 access to crane experts through phone, email and video for instant troubleshooting and problem-solving on issues that require high-level technical knowledge.

Some issues can be resolved quickly, without waiting for a specialist technician to visit. Other times you might need an analysis of the situation to determine if a specialist should see your equipment on-site or not. And if a technical expert is coming, there may be something you can do before arrival to speed up their work.

If you have digital monitoring on your cranes, remote upport can also help you to interpret usage, operation and maintenance data for a more comprehensive view of your needs.

A correctly functioning crane is always a safer crane. Remote support can save you time and money by identifying on-site maintenance actions that you can do with your own team.

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10 Digital services

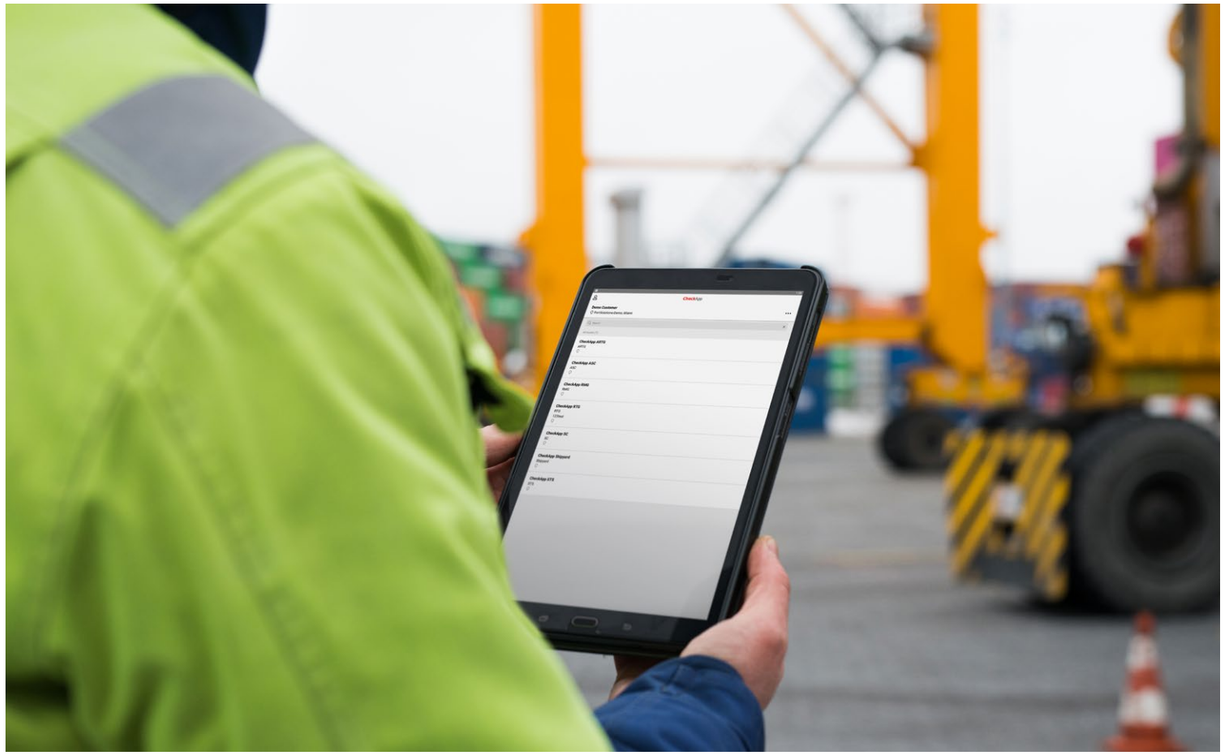
Real-time insights for safer operations

The latest digital services will greatly improve the safety of your ports equipment. Remote monitoring provides up-to-date information about operational performance and maintenance needs at the click of a button. Mobile apps allow more frequent safety inspections. Multiple language versions make them easy to use in any location. When you combine all this information in one digital space, you get a comprehensive picture of your fleet for essential insights into your current operational needs.

Remote monitoring brings real-time data and on-demand reporting to keep your understanding of the condition of your assets fully current. Safety will improve because you now have the information to guide a predictive maintenance program as you identify worn parts and replace them before a malfunction or accident. Email or text alerts can draw attention to the most important issues that need action quickly.

A computerized maintenance management system can automate both the gathering and presentation of your equipment data. To facilitate preventive maintenance, the software's predictive function calculates the estimated remaining service life of components and links you to the OEM online store when you need to procure new parts.

Mobile apps can guide operators and service engineers through daily inspections. The digital format allows the addition of pictures, voice and video for a more comprehensive report. Instant results provide you with an estimate of the current safety and reliability of each asset every time it is used.



An online customer portal provides you with a single central location for access your OEM's digital services, including all your equipment data, service records and manuals. It offers a wide range of data analyses to help optimize and improve your operational processes. And you can do it from any computer or mobile device.

Application programming interfaces (APIs) can integrate data services into your system for an easily scalable and flexible data resource. APIs for remote monitoring, maintenance and mobile apps can work with each other through a single data cloud, reducing the chance of error by eliminating the need to log in to multiple platforms to manually track and copy data from several sources. An ordering API and Open Catalog Interface (OCI) allows you to build direct catalogue browsing and parts ordering flow through your own systems.

With so much data and connectivity, tight cybersecurity is essential to ensure the continued safety of ports equipment. An information security management system compliant with the best practices defined in the ISO/IEC 27001 standard is essential.

When you have access to full online digital services for your ports equipment, updated immediately and available securely 24/7, you can make more informed, data-driven decisions. Accurate and timely information is key to the safe operation, predictive maintenance, and high productivity of all your ports equipment.

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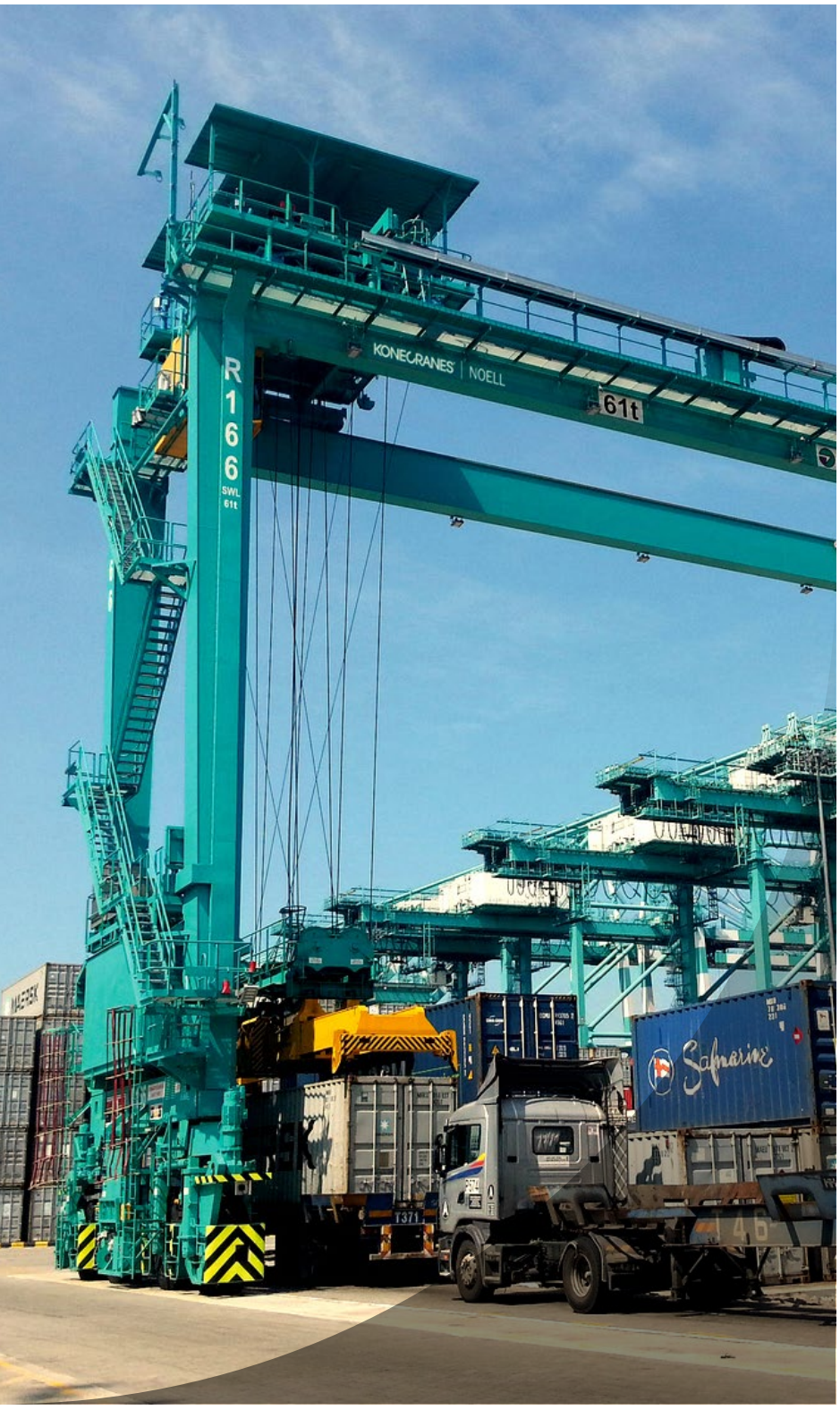

Konecranes is a global leader in material handling solutions, serving a broad range of customers across multiple industries. We consistently set the industry benchmark, from everyday improvements to the breakthroughs at moments that matter most, because we know we can always find a safer, more productive and sustainable way. That's why, with around 16,600 professionals in over 50 countries, Konecranes is trusted every day to lift, handle and move what the world needs. In 2023, Group sales totalled EUR 4.0 billion. Konecranes shares are listed on Nasdaq Helsinki (symbol: KCR).

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